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Chemical composition of some edible wild plants grown in Eastern Anatolia

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Abstract

Eastern Anatolia region, especially Van city with distinguished microclimate, has rich plant diversity in Turkey where *Arum elongatum* Steven subsp. *detrunctum* (C.A.Mey. ex Schott.) H. Riedl, *Capsella bursa – pastoris* (L.) Medik and *Gundelia tournefortii* L. var. *tournefortii* are of well-known and abundantly used species in local cuisine. It is a common phenomenon throughout the world that wild edible plants are good source for minerals and they have useful effects on human health. In this point of view, commonly used wild edible plants mentioned above were analyzed for their nutritive value and mineral compositions. After biological identification, plants were dried under shade and prepared for chemical analysis. Dry matter, total ash, % N, crude protein, crude fibre and pH were determined in the used plants' parts. Additionally, mineral components that are useful or hazardous for human health of the samples were analyzed. *Gundelia tournefortii* L. var. *tournefortii* was the richest in investigated traits among the taxa searched. *Arum elongatum* Steven subsp. *detrunctum* (C.A.Mey. ex Schott.) H. Riedl had also much more minerals. Lowest values were obtained from *Capsella bursa – pastoris* (L.) Medik. Analyzed plant species had good levels of useful chemical composition and lower values for heavy metals.

Keywords: Mineral composition, wild vegetable, Turkey.

1. Introduction

Plants are the main sources for animal and human nutrition. Comparing plant kingdom small amount of them that abundantly consumed have been domesticated and cultivated during human history. Depending on different climates and cultures a number of plant species have been wild collected from nature and used for different purposes. From past to present a number of wild plants, which are known as wild edible plants, have been used as food purposes.

Having highly different climates, plant diversity and rich cultures, Turkey has a great deal of wild edible plants. With distinguished climate and soil properties, Van Lake district located in Eastern Anatolia is rich in plant diversity. A number of wild edible plants species have been collected and consumed as food materials such as vegetables, salads, herbal infusions, spices and condiments, traditional Van Herby cheese additive ^[1]. Due to these benefits, some plant species are being more collected and used in the region. *Arum elongatum* Steven subsp. *detrunctum* (C.A.Mey. ex Schott.) H. Riedl, *Capsella bursa – pastoris* (L.) Medik and *Gundelia tournefortii* L. var. *tournefortii* are of well-known and abundantly used species in the local cuisine. It is common phenomenon that wild edible plants are good source for minerals and they have useful effects on human health. In this point of view, commonly used wild edible plants mentioned above were analyzed their nutritive value and mineral compositions ^[2-5].

However, there are numerous scientific papers on chemical composition and nutritious value of wild edible plants, their content and searched properties are different. In the present work, three mostly collected and consumed wild edible plant species were analyzed all aspects of chemical composition. Thus, dry matter, total ash, total nitrogen, crude protein, crude fibre, pH and mineral components that are useful or hazardous for human health (Ca, Cd, Co, Cr, Cu, Fe, K, Mg, Mn, Na, P, Pb, S and Zn) of the samples were analyzed. The results were compared with previous scientific works.

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2. Material and Methods

2.1. Plant material and preparation of plants for analysis

Mineral compositions and some nutritional properties of three wild edible plant species grown in Van district were analyzed in the present study. The plants were collected from Van Lake

district in 2010. Botanical identifications of the collected plant species from nature were realized according to Flora of Turkey [6] by Dr. Fevzi Ozgokce at Yuzuncu Yil University Biology Department. Some information of the species is given in **Table 1**.

Table 1: Some traits of three wild edible plants from East Anatolia

Plants' Scientific Name	Family	Local Name	Used Parts	Use	Locality	Col. No.
<i>Arum elongatum</i> Steven subsp. <i>detruncatum</i> (C.A.Mey. ex Schott.) H. Riedl	Araceae	Nivik, Karibelk; kari	Aboveground	Meal, roasted, food	L1	F 10382
<i>Capsella bursa – pastoris</i> (L.) Medik,	Brassicaceae	Coban cantasi, kus ekmeği	Aboveground	Meal, roasted, soup, salad	L2	F 12904
<i>Gundelia tournefortii</i> L. var. <i>tournefortii</i>	Asteraceae	Kenger, Gerenk	Leaf and shoot, fruit	Roasted, salad, pickle, coffee	L3	F 11497

L1: B9 Van: Gevas, north slopes of Alacabuk Mountain, sand dunes of Altinsac village, 1750 m.

L2: B9 Van: Gevas, north slopes of Alacabuk Mountain, sand dunes of Altinsac village, 1750 m.

L3: B9 Bitlis: Tatvan, north of Alacabuk mountain Gencler area, stony slopes, 2100 m

Before chemical analysis, plants were cleaned from foreign materials, separated used parts and washed with deionized water, dried at room temperature, ground, packaged in plastic bags and kept for analysis in the laboratory.

2.2. Dry matter and total ash determination

To determine the dry matter content of the samples, the materials were dried at 105 °C for 24 hours in oven. Then, the oven-dried samples were weighed and recorded. Electric Muffle Furnace set at 550 °C was used for determination of total ash content (inorganic matter). After completion of ashing, total ash content was calculated.

2.3. Total nitrogen determination and crude protein calculation

Kjeldahl apparatus and method were used to find of total nitrogen content of the samples. After total nitrogen content determination, crude protein contents were calculated by below formulas.

1. %Nitrogen = $\frac{(V_1 - V_2) \times N \times 0.014}{m} \times 100$
2. %Protein = %Nitrogen x F

2.4. pH, total crude fibre and total mineral determination

pH values were determined by pH-meter in the plant samples. Crude fibre analyses were accomplished by AOAC method "962.09" (AOAC, 2000). Mineral compositions of the

sampled were made as follows: dried plant samples were ashed in a furnace by nitric (AR) and hydrochloric acid (AOAC). Afterwards, distilled water (50 ml) was added to samples in a volumetric flask. All the analyses were repeated in three times and standard materials were used for chemical analyses. Atomic Absorption Spectrometry was used for determination of mineral contents. The data obtained from chemical analyses, mean values were calculated and are given in the table with their standard deviations.

3. Results and Discussion

A. elongatum, *C. pastoris* and *G. tournefortii* are well-known and abundantly used species. These wild edible plant species were screened for their main chemical compositions. The data obtained from chemical analyses were statistically analyzed and mean values are given with their standard deviations (**Tables 2, 3**).

Chemical analysis results showed that *G. tournefortii* was the richest among the analyzed plant species for chemicals. Total ash, nitrogen, crude protein, crude fibre contents (%), K, P, Mn, Fe, Cu and Cd concentrations were higher than other species studied. *A. elongatum* had the highest values for pH, Na, Mg, Ca, S, Zn and Pb. It could be said that *C. bursa – pastoris* was the poorest among the analyzed plant species (**Tables 2, 3**).

Table 2: Mean values of chemical composition values of some wild edible plants

Parameters	<i>A. elongatum</i>			<i>C. bursa – pastoris</i>			<i>G. tournefortii</i>		
Dry matter (%)	14.36	±	0.99	18.72	±	0.85	17.46	±	1.08
Total ash (%)	6.67	±	1.15	7.50	±	0.70	15.33	±	1.16
N (%)	1.35	±	0.04	2.94	±	0.08	3.34	±	0.17
Crude protein (%)	8.47	±	0.28	17.84	±	0.56	21.00	±	0.84
pH	6.53	±	0.12	6.11	±	0.18	6.05	±	0.14
Crude Fibre (%)	19.38	±	0.67	24.30	±	0.94	36.44	±	1.48

Dry matter contents of analyzed plant samples changed between 14.36 and 18.72 % (**Table 2**). Sekeroglu *et al.* [3] stated that dry matter content of some wild vegetables consumed in Black Sea Region of Turkey was between 7.5 – 18.5%. They found the highest dry matter content in *Ornithogalum umbellatum*. Yildirim *et al.* [7] also reported dry matter contents of some wild vegetables varied from 11.89 to

20.87 %. Total ash content of the samples varied from 6.67 to 15.33 % (**Table 2**).

According to previous scientific reports, total ash content of different wild edible plants was between 7.00 and 26.70 % [3, 7]. In these studies, the highest total ash content was found in *Urtica urens* [8]. According to chemical analysis, total N and crude protein contents were in intervals 1.35 – 3.34 and 8.47 –

21.00 %, respectively (**Table 2**). In different scientific studies, total ash and crude protein content of some medicinal and edible plants were reported as 0.20 – 1.70 % and 1.30 – 11.56 % [3, 7, 8]. In this work, pH values of analyzed plant parts varied from 6.05 – 6.53. Yildirim *et al.* [7] reported that pH values of some wild vegetables changes between 3.50 – 6.50. Crude fibre contents of analyzed plant samples found between 19.38 – 36.44 % (**Table 2**). Vishwakarma and Dubey [9] studied nutritional values of indigenous wild edible herbs used in

Eastern Chhattisgarh, India and reported that crude fibre contents of the analyzed plants varied from 0.90 (*Moringa oleifera*) to 28.59 % (*Marsilea minuta*). Data obtained from chemical analyses for dry matter, total ash, total nitrogen, crude protein, pH and crude fibre are in harmony with the previous reports on wild vegetables. The reports given above states also that chemical composition of plants are affected by a number of internal and external factors such as plant genetic structure, growing conditions, soil properties, used plant parts etc.

Table 3: Mean values of mineral compositions of some wild edible plants

Minerals	<i>A.elongatum</i>			<i>C.bursa – pastoris</i>			<i>G.tournefortii</i>		
Na (g kg ⁻¹)	1.21	±	0.02	0.44	±	0.04	1.00	±	0.05
Mg (g kg ⁻¹)	5.20	±	0.07	1.55	±	0.13	3.31	±	0.06
K (g kg ⁻¹)	22.13	±	0.08	19.23	±	1.11	26.02	±	0.21
Ca (g kg ⁻¹)	14.56	±	0.28	9.35	±	0.09	8.51	±	0.05
P (g kg ⁻¹)	3.27	±	0.06	2.40	±	0.07	4.23	±	0.06
S (g kg ⁻¹)	2.10	±	0.36	1.36	±	0.04	1.49	±	0.07
Mn (mg kg ⁻¹)	16.45	±	0.33	47.83	±	2.02	178.53	±	1.29
Fe (mg kg ⁻¹)	134.08	±	18.12	254.55	±	9.34	408.37	±	4.40
Cu (mg kg ⁻¹)	10.33	±	0.12	12.53	±	0.51	27.91	±	3.37
Zn (mg kg ⁻¹)	28.37	±	0.34	23.82	±	0.61	20.05	±	0.21
Cr (mg kg ⁻¹)	0.31	±	0.02	0.49	±	0.08	0.29	±	0.02
Cd (mg kg ⁻¹)	0.04	±	0.01	0.08	±	0.01	0.09	±	0.01
Co (mg kg ⁻¹)	0.22	±	0.29	1.26	±	0.07	1.08	±	0.09
Pb (mg kg ⁻¹)	0.45	±	0.08	0.06	±	0.02	0.04	±	0.01

According to analysis results, mineral compositions of analyzed plant samples were highly different (**Table 3**). In general, *A.elongatum* and *G.tournefortii* gave the highest mineral composition, the lowest values were obtained from *C.bursa – pastoris*.

In this work, the highest sodium, magnesium, calcium, sulphur was determined in *A.elongatum* samples and *G.tournefortii* had the highest potassium and phosphorus values in the first part of the determined minerals (**Table 3**). Wild vegetables and medicinal plants have been studied for their mineral composition as follows. In these studies are summarized for the above minerals for comparison: Na concentrations ranged from 0.21 to 63.32 g kg⁻¹ [5, 10-13]; magnesium levels for medicinal and edible plants were reported between 1.17 and 86.43 g kg⁻¹ [5, 8, 10, 14].

Potassium content changed from 245.78 to 557.91 g kg⁻¹ in wild vegetables [5]; calcium concentrations were found in a wide range from 0.03 to 777.52 g kg⁻¹ [5, 12, 13]; phosphorus content varied from 34.92 to 69.13 g kg⁻¹ [5, 15]; sulphur concentrations were reported in the range of 12.34–108.01 g kg⁻¹ [5, 12, 13]. Considering previous studies on macro element concentrations of some medicinal and wild edible plants, our findings are in harmony with the researchers' results. It is well known that a number of factors affect plant compositions, including soil characteristics, water availability in the soil, etc., considerably affect mineral composition of plants [16]. In this study, there was also a wide variation for macro element contents among the studied plant species.

Among the analyzed plant species, while the highest zinc and lead concentrations were obtained from *A. elongatum* samples, *G.tournefortii* gave the highest Mn, Fe, Cu and Cd levels (**Table 3**). Interestingly, *C.bursa – pastoris* had higher Cr, Cd and Co, which are known as heavy metals, levels. Mineral compositions in the previously published data

in medicinal plants and wild edible vegetables are as follows: Mn levels were in the ranges of 5 – 244 mg kg⁻¹ [4, 17, 18]. With respect to the iron (Fe) levels, the mean content ranges were ascertained to range from 1.70 to 975.00 mg kg⁻¹ [3, 5, 7, 8, 18-20]. Mean contents of Cu vary from 0.05 – 18.4 mg kg⁻¹ for edible plants [5, 7, 8, 20-22]. Zinc levels reported in previous studies for edible plants were 10 – 97 mg kg⁻¹ [23-25]. The minerals mentioned above are thought to be useful for human health and participate in a number of physiological functions in living organisms. In the present study, determined concentrations of the minerals are in accordance with the previous studies.

Contents of Cr, Cd, Co and Pb are limited and trace levels in the analyzed plant samples (**Table 3**). Chromium concentrations of some edible and medicinal plants were reported as 0.65–19.10 mg kg⁻¹ [5, 12, 13, 26].

Cadmium concentrations were found between 0.012 – 0.440 mg kg⁻¹ for medicinal plants and wild vegetables [4, 12, 18, 27, 28]. Cobalt concentrations of some edible plants were determined in previous studies varied from 0.047 – 1.69 mg kg⁻¹ [5, 12, 29]. Pb concentrations of wild edible plants found between 0.04 – 1.40 mg kg⁻¹ [5]. Heavy metal concentrations are lower than previously published findings.

4. Conclusion

Wild vegetable are of good sources for mineral and other useful chemical for human health. Scientific studies stated that comparing cultivated crops under traditional agricultural practices, wild edible plants are rich in useful chemicals and free from hazardous heavy metals. Wild edible plants, especially growing far from industrial areas and highways, under forests, in pastures and meadows could be thought to be less exposed to pollution. Moreover, they have clean soil and weather in their growing conditions. According to scientific reports, thus, it could be said that wild edible plants

are some safer and useful than cultivated ones. In the present work, some wild edible plant species abundantly collected wild and consumed in Eastern Anatolia were screened their chemical compositions. The results were compared with previous reports.

In conclusion, analyzed plant species had good levels of useful chemical and lower values for heavy metals.

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